UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/038,168	10/23/2001	Gregory L. Heacock	12726US02	7813

7590 04/21/2005

McANDREWS, HELD & MALLOY, LTD.
34th Floor
500 W. Madison Street
Chicago, IL 60661

EXAMINER	
WERNER, BRIAN P	
ART UNIT	PAPER NUMBER
2621	

DATE MAILED: 04/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/038,168	Applicant(s) HEACOCK, GREGORY L.
	Examiner Brian P. Werner	Art Unit 2621

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-55* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *30-39* is/are allowed.

6)☒ Claim(s) *1-3,5-17,19-23,25-29 and 40-55* is/are rejected.

7)☒ Claim(s) *4,18 and 24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 February 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/6/03*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. The following quotations of 37 CFR § 1.75(a) is the basis of objection:

> (a) The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

2. Claims 18 and 45 are objected to under 37 CFR § 1.75(a) as failing to particularly point out and distinctly claim the subject matter which the applicant regards as his invention or discovery.

Claim 45 improperly depends from claim 41, which recites essentially the same limitations. It appears that claim 45 should depend from claim 43, and this will be assumed for examination purposes.

Claim 18 lacks an antecedent basis for "the predetermined distance". Claim 18 will be assumed to depend from claim 22, which provides the proper antecedent, for examination purposes.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 40 is rejected under 35 U.S.C. 102(e) as being anticipated by Miller et al. (US 6,690,466 B2).

Miller discloses a retinal imaging device (figure 4a, "retinal imaging station" at column 13, line 63), comprising:

red and green light emitting diodes combined to illuminate the eye ("Nineteen LEDs having wavelengths from 420-690 nm …" at column 6, line 33);

a lens through which light passes to illuminate the retinal and from which light is received from the retina (referring to figure, an objective lens is situation adjacent the eye through and from which light passes); and

an image signal generator generating an image of the illuminated retina (figure 4a, numeral 61).

5. Claims 46, 47, 48, 50, 51, 52, 53 and 54 are rejected under 35 U.S.C. 102(e) as being anticipated by Rice et al. (US 6,305,804 B1).

Regarding claim 53, Rice discloses:

directing light from an LED to illuminate the retina (figure 1, numeral 12; "laser diodes" at column 4, line 45);

directing light reflected from the illuminated retinal to an image signal generator (figure 1, numeral 11, 12 and 22);

generating at least one visual target to align the eye with the device ("a coaxial 'scene' or visual target … in the visual field" at column 4, line 59; "the location of this visual target will bring the optic disk into the approximate center of the CCD detector" at column 4, line 63);

determining alignment of the eye with the device ("the operator for initially locating the patient's retina, based on an image from the optical system in real time" at column 4, line 56); and

generating a signal representing an image of the retina when the eye is aligned (figure 1, numeral 22; figure 3, numeral 26 is the trigger; once the patient is looking at the target and the operator can see that the retinal is in the proper field of view, the trigger is pulled to capture an image).

Regarding claim 54, illumination is on the entire time while the patient is looking into the device, thus the illumination is on "after determining the eye is in alignment" and "before the image signal is generated" as required by the claim.

Regarding claim 50, Rice discloses:

directing light from an LED to illuminate the retina (figure 1, numeral 12; "laser diodes" at column 4, line 45);

directing light reflected from the illuminated retinal to an image signal generator (figure 1, numeral 11, 12 and 22); and

generating a visual target to align the eye alone an axis and at a distance from the device ("a coaxial 'scene' or visual target … in the visual field" at column 4, line 59; "the location of this visual target will bring the optic disk into the approximate center of the CCD detector" at column 4, line 63; thus, given the target aligns the eye with the center of the CCD, then the eye is aligned in both the x and the y axis of the system as a CCD is a two-dimensional array device; the alignment also places the eye at a predetermined distance from the device; that is, "focus system 16 … automatically find and bring the optic disk into focus" at column 5, line 22; "a motor drive system that slightly gimbals the lens system" at column 5, line 38 – thus, the lens system is moved to bring the retina into focus; Overall, Rice's fixation target in combination with the motor driven lens system serves to align the eye in the x, y and z coordinates necessary for capturing an in-focus system).

Regarding claim 51, Rice discloses:

directing light from an LED to illuminate the retina (figure 1, numeral 12; "laser diodes" at column 4, line 45);

directing light reflected from the illuminated retinal to an image signal generator (figure 1, numeral 11, 12 and 22);

generating a visual target to align the eye alone an axis and at a distance from the device ("a coaxial 'scene' or visual target … in the visual field" at column 4, line 59; "the

location of this visual target will bring the optic disk into the approximate center of the CCD detector" at column 4, line 63; thus, given the target aligns the eye with the center of the CCD, then the eye is aligned in both the x and the y axis of the system as a CCD is a two-dimensional array device; the alignment also places the eye at a predetermined distance from the device; that is, "focus system 16 … automatically find and bring the optic disk into focus" at column 5, line 22; "a motor drive system that slightly gimbals the lens system" at column 5, line 38 – thus, the lens system is moved to bring the retina into focus; Overall, Rice's fixation target in combination with the motor driven lens system serves to align the eye in the x, y and z coordinates necessary for capturing an in-focus system);

determining alignment of the eye with the device ("the operator for initially locating the patient's retina, based on an image from the optical system in real time" at column 4, line 56); and

generating a signal representing an image of the retina when the eye is aligned (figure 1, numeral 22; figure 3, numeral 26 is the trigger; once the patient is looking at the target and the operator can see that the retinal is in the proper field of view, the trigger is pulled to capture an image).

Regarding claim 52, illumination is on the entire time while the patient is looking into the device, thus the illumination is on "after determining the eye is in alignment" and "before the image signal is generated" as required by the claim.

Regarding claim 46, Rice discloses:

directing light from an LED to illuminate the retina (figure 1, numeral 12; "laser diodes" at column 4, line 45);

directing light reflected from the illuminated retinal to an image signal generator (figure 1, numeral 11, 12 and 22);

generating a visual target to align the eye alone an axis and at a distance from the device ("a coaxial 'scene' or visual target ... in the visual field" at column 4, line 59; "the location of this visual target will bring the optic disk into the approximate center of the CCD detector" at column 4, line 63; thus, given the target aligns the eye with the center of the CCD, then the eye is aligned in both the x and the y axis of the system as a CCD is a two-dimensional array device; the alignment also places the eye at a predetermined distance from the device; that is, "focus system 16 ... automatically find and bring the optic disk into focus" at column 5, line 22; "a motor drive system that slightly gimbals the lens system" at column 5, line 38 – thus, the lens system is moved to bring the retina into focus; Overall, Rice's fixation target in combination with the motor driven lens system serves to align the eye in the x, y and z coordinates necessary for capturing an in-focus system);

determining when the eye is at a predetermined distance from the system ("the operator for initially locating the patient's retina, based on an image from the optical system in real time" at column 4, line 56; once the image is centered and in focus as adjusted by the focusing system, the trigger at figure 3, numeral 26 is pulled to capture an image; if the user were not within an adequate distance from the device as predetermined by the optical system, then the image as viewed by the operator would not be in-focus and the device would require adjustment; for example, of the patient was three-feet away from the system, an in-focus image of the retina would be result and the operator would move the device closer to the eye; this distance adjustment is axiomatic to the system, as

it is clear from the disclosure as a whole that the device must be near the pupil, or at least within a certain distance from the optical system in order for an in-focus image to appear on the screen).

Regarding claim 47, Rice discloses:

directing light from an LED to illuminate the retina (figure 1, numeral 12; "laser diodes" at column 4, line 45);

directing light reflected from the illuminated retinal to an image signal generator (figure 1, numeral 11, 12 and 22);

generating a visual target to align the eye alone an axis and at a distance from the device ("a coaxial 'scene' or visual target ... in the visual field" at column 4, line 59; "the location of this visual target will bring the optic disk into the approximate center of the CCD detector" at column 4, line 63; thus, given the target aligns the eye with the center of the CCD, then the eye is aligned in both the x and the y axis of the system as a CCD is a two-dimensional array device; the alignment also places the eye at a predetermined distance from the device; that is, "focus system 16 ... automatically find and bring the optic disk into focus" at column 5, line 22; "a motor drive system that slightly gimbals the lens system" at column 5, line 38 – thus, the lens system is moved to bring the retina into focus; Overall, Rice's fixation target in combination with the motor driven lens system serves to align the eye in the x, y and z coordinates necessary for capturing an in-focus system);

determining when the eye is at a predetermined distance from the system ("the operator for initially locating the patient's retina, based on an image from the optical system in real time" at column 4, line 56; once the image is centered and in focus as

adjusted by the focusing system, the trigger at figure 3, numeral 26 is pulled to capture an image; if the user were not within an adequate distance from the device as predetermined by the optical system, then the image as viewed by the operator would not be in-focus and the device would require adjustment; for example, of the patient was three-feet away from the system, an in-focus image of the retina would be result and the operator would move the device closer to the eye; this distance adjustment is axiomatic to the system, as it is clear from the disclosure as a whole that the device must be near the pupil, or at least within a certain distance from the optical system in order for an in-focus image to appear on the screen) and

generating a signal representing an image of the retina when the eye is aligned (figure 1, numeral 22; figure 3, numeral 26 is the trigger; once the patient is looking at the target and the operator can see that the retinal is in the proper field of view, the trigger is pulled to capture an image).

Regarding claim 48, illumination is on the entire time while the patient is looking into the device, thus the illumination is on "after determining the eye is in alignment" and "before the image signal is generated" as required by the claim.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 8, 9, 10, 14, 46, 47, 48, 50, 51 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Kim et al. (US 6,594,377 B1).

Regarding claim 1, Rice discloses:

an illumination source (figure 1, numeral 12);

a lens through which light passes to illuminate the retina, the lens receiving light reflected from the retina (figure 1, numeral 11); and

an image signal generator responsive to the reflected light to generate a signal representing an image or the illuminated retina (figure 1, numeral 22).

While Rice discloses an alignment system for ensuring that an adequate focus is achieved ("focus system 16 ... automatically find and bring the optic disk into focus" at column 5, line 22; "a motor drive system that slightly gimbals the lens system" at column 5, line 38 – thus, the lens system is moved to bring the retina into focus),

Rice does not disclose an ultrasonic transducer, the system being responsive to the transducer to determine when the eye is a predetermined distance from the image capture device and providing an indication to the user when the eye is at the predetermined distance.

Kim discloses a system for photographing an eye (figures 2-4), comprising an ultrasonic distance transducer ("the distance detector 18 measures a distance by using the infrared light. However, a detector using an ultrasonic wave may be employed" at column 3, line 59), the system being responsive to the transducer to determine when the eye is a predetermined distance from the image capture device ("the distance detector 18 measures a distance between the user and the optical imager, and transmits the measured distance value to the controller 200 through the optical imager driving unit 24. The control unit 200 judges whether the eye of the user is positioned within a predetermined operational range" at column 4, line 33) and providing an indication to the user when the eye is at the predetermined distance ("When it is judged that the user is positioned within the operational range, the control unit 200 outputs the control signal to the optical imager 100, thereby automatically enabling the optical imager 100. That is, the camera 10 prepares for capturing the iris image of the user, and simultaneously optical imager driving unit 24 outputs to the outside indicator 22 an active signal informing that the optical imager 100 is enabled" at column 4, line 35).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to incorporate the distance detector of Kim, into the system disclosed by Rice, to judge when the user is in the "operational range" (Kim, column 4, line 33), and then to activate the detector for capturing the image and to output an outside "signal informing that the optical imager 100 is enabled" (Kim, column 4, line 41). One would be motivated to do so by the following factors:

To inform the user of immanent image capture and to therefore remain still;

To properly and accurately adjust the focus mechanism based on the exact distance determined as described by Kim at column 4, line 53 through column 5, line 5 (see "The control unit 200 receives the distance value, computes a zoom-in/zoom-out value and a focus value by using a property table of the camera according to a value corresponding to the distance value, and controls a zoom motor and a focus motor of the camera according to the computed value" and "decides a zoom magnification from the zoom magnification table of the camera according to the previously-set distance by using the distance value between the camera and the iris, transmits the control signal to the camera, and controls the zoom motor of the camera. Accordingly, the zoom lens is directly moved, the focus lens is moved to a corresponding position by controlling the focus motor, and thus the focus is directly controlled"), and

to increase the focusing speed ("the focusing speed is increased" at Kim, column 5, line 5).

Regarding claims 8 and 9, Kim's indicator is visual and audible ("an outside indicator 22 indicating a result with predetermined lamps" at column 3, line 10; "an outside indicator 22/speaker 20-2" at column 3, line 45).

Regarding claim 10, Rice's illumination is non-scanned (e.g. "xenon strobe ... halogen source" at column 4, line 45).

Regarding claim 14, Rice discloses a CCD camera (figure 1, numeral 22).

Claims 46, 47, 48, 50, 51 and 52 are all met by the Rice and Kim combination as described above.

8. Claims 2, 3, 5, 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Kim et al. (US 6,594,377 B1) as applied to claim 1 above, and further in combination with Horiguchi et al. (US 6,490,365 B2).

Regarding claims 2, 3 and 7, while Rice discloses a visual target to align the eye ("a coaxial 'scene' or visual target … in the visual field" at column 4, line 59; "the location of this visual target will bring the optic disk into the approximate center of the CCD detector" at column 4, line 63),

Rice does not teach an elongated channel having an end into which the user looks and a longitudinal axis at an angle with respect to a centerline of the lens, a light disposed in the channel at a distance from the end into which the user looks where the light is visible when the eye is aligned.

Horiguchi discloses an eye imaging device ("eye image pickup device" at column 1, line 56) comprising an alignment system ("one person can determine the precise direction in which to move one's eye" at column 2, line 5). The alignment system includes an elongated channel (figure 6, numeral 9; "optical fiber cable 9" at column 4, line 61) having an end into which the user looks (figure 6, numeral 11) and a longitudinal axis at an angle with respect to a centerline of the lens (referring to figure 6, the longitudinal axis of numeral 9 is substantially 90 degrees w.r.t. the objective lens axis), a light disposed in the channel at a distance from the end into which the user looks (figure 6, numeral 10; "LED 10" at column 4, line 65) where the light is visible when the eye is aligned ("With this setting, when the light shielding portion 3 and the visible guide light 6

are viewed along the light axis 5 from the outside of the mirror barrel 8, they have the same appearance as the annular eclipse shown in FIG. 2(a)" at column 5, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to incorporate, as the visual target system required by Rice, the elongated channel target system taught by Horiguchi. One would be motivated to do so because the Horiguchi target system is simple (Horiguchi, "simply structured" at column 1, line 55), it can "be mounted in a variety of devices, specifically including portable devices" (Horiguchi, column 1, line 56), and it can facilitate the capture of "precise eye images" (Horiguchi, column 1, line 57), where the owing to the size and location of the marker (i.e. Horiguchi figure 6, numeral 3), the "size of the eye image pickup device is not increased" (Horiguchi, column 2, line 14) and "the marker can be easily recognized visually" (Horiguchi, column 2, line 16).

Regarding claims 5 and 6, looking at Horiguchi's channel 9 in figure 6, the ratio of it's width at the end where it meets LED 10, to it's overall length is approximately 1:12, or 1/14 = .07, thus meeting the claim requirement. Regarding claim 6, 0.7 is "approximately" .04.

9. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Kim et al. (US 6,594,377 B1) as applied to claim 1, and further in combination with Dreher et al. (US 5,303,709 A).

While Rice teaches a lens for focusing a retinal image onto a CCD camera (i.e., figure 1, numerals 11 and 22), Rice does not teach a pinhole lens through which light passes to the capture device.

Dreher discloses a retinal imaging device (figure 7) comprising a pin hole lens (numeral 73) through which light passes to the capture device (numeral 75).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the pinhole lens as taught by Dreher, in order to form the retinal image onto the capture device of Rice, to "eliminate light not returning from the selected focal plane in the eye" (Dreher, column 7, line 30) and so that "stray light reflected from other areas of the focal points is blocked by the pinhole ... cannot reach the [imaging device]" (Dreher, column 5, line 40), thus providing a more accurate image of the retina.

10. Claims 11, 12 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Kim et al. (US 6,594,377 B1) as applied to claim 1, and further in combination with Miller et al. (US 6,690,466 B2).

Rice discloses an illumination source (figure 1, numeral 12), and while Rice states, "the frequency content of this light source is selected dependent upon the compound to be analyzed", where "illumination light may be composed of two (or more) separate lighting systems" at column 4, line 43,

Rice does not teach the specific configuration of the light source, including a red light emitting diode and a green light emitting diode to illuminate the eye.

Miller discloses an illumination system ("illuminator to illuminate a sample" at column 3, line 40), having use in a retinal imaging system as described in the 102 rejection above, comprising a red light emitting diode and a green light emitting diode that combine to illuminate a sample ("provide light having any desired distribution of wavelengths across a broad range" where "all bands may be on, with precisely chosen

amounts of light in each band" at column 3, lines 40-45; "Nineteen LEDs having wavelengths from 420-690 nm …" at column 6, line 33; this spectrum covers the entire visual range, including red and green).

It would have been obvious at the time the invention was made to incorporate, as the illumination system required by Rice (e.g., Rice figure 1, numeral 12, the illumination system taught by Miller as described above. One would be motivated to do so in order to facilitate Rice's selection of frequency content using two or more lighting systems (i.e., "the frequency content of this light source is selected dependent upon the compound to be analyzed", where "illumination light may be composed of two (or more) separate lighting systems" at Rice column 4, line 43) by providing a multitude of light sources (e.g., nineteen LEDs at Miller column 6, line 33) that can provide "any desired distribution" (Miller, column 3, line 42) thus providing Rice with precise and accurate control over the illumination, where any frequency content desired can be achieved. Other benefits and advantages of the Miller system are describe throughout the Miller disclosure, including "simplicity and speed" at column 14, line 22.

11. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Kim et al. (US 6,594,377 B1) as applied to claim 1, and further in combination with Heacock (US 5,861,938 A).

While Rice requires a lens system that includes a "final lens which can be positioned close to … the cornea" at column 4, line 27,

Rice does not teach specific optical arrangements, including an aspheric surface.

Heacock discloses a retinal imaging system (figures 1 and 2), comprising an aspheric objective lens system (figure 2, numeral 50; "The illumination light as it travels towards the patient's eye 14 is slightly diverging. The weaker surface 52 of the aspheric lens makes the slightly diverging illumination light parallel and directs the illumination light to the stronger surface 54 of the aspheric lens 50. The stronger surface 54 of the aspheric lens focuses the illumination light to a point 56 that is centered on the patient's pupil or generally proximate thereto. The illumination light continues its path until it strikes the retina 58 of the eye 14, thus illuminating an area of the patient's eye within the boundaries of the rays 60 and 62" at column 5, line 35; see Heacock column 6):

> The aspheric lens 50 of the present invention focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22. In order to provide such an aspheric lens, each surface 52 and 54 of the lens is preferably described by the polynomial function:
>
> $$f(Y, A_2, A_4, A_6, C, cc) = A_2Y^2 + A_4Y^4 + A_6Y^6 + CY^2 / \left(1 + \sqrt{1 - C^2cc}\right)$$
>
> where A_2, A_4 and A_6 are constants; C represents the curvature of the surface; and cc represents the conic constant. For the stronger surface 54 of the lens 50, these values should be within the following ranges:

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize, as the "final lens system" required by Rice, the aspheric lens taught by Heacock as described above. One would be motivated to do so in order to fulfill Rice's requirement for a lens that can be placed close to the cornea ("final lens

which can be positioned close to … the cornea" at Rice column 4, line 27). That is, Heacock's lens "focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22" at Heacock column 6, line 20 and as depicted in figures 1 and 2. Thus, the lens of Heacock can be placed close to the cornea and can serve to illuminate the retina and also focus light reflected from the retinal back to the image plane making it a simple, single lens solution to Rice's optical system which also serves to reduce the overall weight of the portable system disclosed by Rice (e.g., Rice figures 3 and 4). One would also be motivated to utilize the Heacock lens because "the aspheric lens 50 produces a 60 degree field of view … which is extremely wide" at column 6, line 68, where "the real image produced by the aspheric lens 50 is substantially free from distortions" at column 7, line 4.

12. Claims 16, 17, 19, 20, 21, 25 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Horiguchi et al. (US 6,490,365 B2).

Regarding claim 16, Rice discloses:

an illumination source (figure 1, numeral 12);

a lens through which light passes to illuminate the retina, the lens receiving light reflected from the retina (figure 1, numeral 11); and

an image signal generator responsive to the reflected light to generate a signal representing an image or the illuminated retina (figure 1, numeral 22).

While Rice discloses a visual target to align the eye ("a coaxial 'scene' or visual target ... in the visual field" at column 4, line 59; "the location of this visual target will bring the optic disk into the approximate center of the CCD detector" at column 4, line 63),

Rice does not teach an elongated channel having an end into which the user looks and a longitudinal axis at an angle with respect to a centerline of the lens, an object disposed in the channel at a distance from the end into which the user looks where the object is visible when the eye is aligned.

Horiguchi discloses an eye imaging device ("eye image pickup device" at column 1, line 56) comprising an alignment system ("one person can determine the precise direction in which to move one's eye" at column 2, line 5). The alignment system includes an elongated channel (figure 6, numeral 9; "optical fiber cable 9" at column 4, line 61) having an end into which the user looks (figure 6, numeral 11) and a longitudinal axis at an angle with respect to a centerline of the lens (referring to figure 6, the longitudinal axis of numeral 9 is substantially 90 degrees w.r.t. the objective lens axis), an object disposed in the channel at a distance from the end into which the user looks (figure 6, numeral 10; "LED 10" at column 4, line 65) where the object is visible when the eye is aligned ("With this setting, when the light shielding portion 3 and the visible guide light 6 are viewed along the light axis 5 from the outside of the mirror barrel 8, they have the same appearance as the annular eclipse shown in FIG. 2(a)" at column 5, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to incorporate, as the visual target system required by Rice, the elongated channel target system taught by Horiguchi. One would be motivated to do so because the Horiguchi target system is simple (Horiguchi, "simply structured" at column 1, line 55), it can "be mounted in a variety of devices, specifically including portable devices" (Horiguchi, column 1, line 56), and it can facilitate the capture of "precise eye images" (Horiguchi, column 1, line 57), where the owing to the size and location of the marker (i.e. Horiguchi figure 6, numeral 3), the "size of the eye image pickup device is not increased" (Horiguchi, column 2, line 14) and "the marker can be easily recognized visually" (Horiguchi, column 2, line 16).

Regarding claim 17, Horiguchi's object is a light (figure 6, numeral 10; "LED 10" at column 4, line 65).

Regarding claim 19, looking at Horiguchi's channel 9 in figure 6, the ratio of it's width at the end where it meets LED 10, to it's overall length is approximately 1:12, or 1/14 = .07, thus meeting the claim requirement. Regarding claim 20, 0.7 is "approximately" .04.

Regarding claim 21, Horiguchi's channel has a black wall ("fiber cable 9 is coated with black in order to minimize any effect it may have on the image pickup element 2" at column 5, line 7).

Regarding claim 25, Rice's illumination is non-scanned (e.g. "xenon strobe ... halogen source" at column 4, line 45).

Regarding claim 29, Rice discloses a CCD camera (figure 1, numeral 22).

13. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Horiguchi et al. (US 6,490,365 B2) as applied to claim 16, and further in combination with Heacock (US 5,861,938 A).

While Rice requires a lens system that includes a "final lens which can be positioned close to ... the cornea" at column 4, line 27,

Rice does not teach specific optical arrangements, including an aspheric surface.

Heacock discloses a retinal imaging system (figures 1 and 2), comprising an aspheric objective lens system (figure 2, numeral 50; "The illumination light as it travels towards the patient's eye 14 is slightly diverging. The weaker surface 52 of the aspheric lens makes the slightly diverging illumination light parallel and directs the illumination light to the stronger surface 54 of the aspheric lens 50. The stronger surface 54 of the aspheric lens focuses the illumination light to a point 56 that is centered on the patient's pupil or generally proximate thereto. The illumination light continues its path until it strikes the retina 58 of the eye 14, thus illuminating an area of the patient's eye within the boundaries of the rays 60 and 62" at column 5, line 35; see Heacock column 6):

> The aspheric lens 50 of the present invention focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22. In order to provide such an aspheric lens, each surface 52 and 54 of the lens is preferably described by the polynomial function:
>
> $$f(Y, A_2, A_4, A_6, C, cc) = A_2Y^2 + A_4Y^4 + A_6Y^6 + CY^2 / \left(1 + \sqrt{1 - C^2cc}\right)$$
>
> where A_2, A_4 and A_6 are constants; C represents the curvature of the surface; and cc represents the conic constant. For the stronger surface 54 of the lens 50, these values should be within the following ranges:

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize, as the "final lens system" required by Rice, the aspheric lens taught by Heacock as described above. One would be motivated to do so in order to fulfill Rice's requirement for a lens that can be placed close to the cornea ("final lens which can be positioned close to … the cornea" at Rice column 4, line 27). That is, Heacock's lens "focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22" at Heacock column 6, line 20 and as depicted in figures 1 and 2. Thus, the lens of Heacock can be placed close to the cornea and can serve to illuminate the retina and also focus light reflected from the retinal back to the image plane making it a simple, single lens solution to Rice's optical system which also serves to reduce the overall weight of the portable system disclosed by Rice (e.g., Rice figures 3 and 4). One would also be

motivated to utilize the Heacock lens because "the aspheric lens 50 produces a 60 degree field of view … which is extremely wide" at column 6, line 68, where "the real image produced by the aspheric lens 50 is substantially free from distortions" at column 7, line 4.

14. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Horiguchi et al. (US 6,490,365 B2) as applied to claim 16, and further in combination with Miller et al. (US 6,690,466 B2).

While Rice states, "the frequency content of this light source is selected dependent upon the compound to be analyzed", where "illumination light may be composed of two (or more) separate lighting systems" at column 4, line 43,

Rice does not teach the specific configuration of the light source, including a red light emitting diode and a green light emitting diode.

Miller discloses an illumination system ("illuminator to illuminate a sample" at column 3, line 40), having use in a retinal imaging system as described in the 102 rejection above, comprising a red light emitting diode and a green light emitting diode that combine to illuminate a sample ("provide light having any desired distribution of wavelengths across a broad range" where "all bands may be on, with precisely chosen amounts of light in each band" at column 3, lines 40-45; "Nineteen LEDs having wavelengths from 420-690 nm …" at column 6, line 33; this spectrum covers the entire visual range, including red and green).

It would have been obvious at the time the invention was made to incorporate, as the illumination system required by Rice (e.g., Rice figure 1, numeral 12, the illumination

system taught by Miller as described above. One would be motivated to do so in order to facilitate Rice's selection of frequency content using two or more lighting systems (i.e., "the frequency content of this light source is selected dependent upon the compound to be analyzed", where "illumination light may be composed of two (or more) separate lighting systems" at Rice column 4, line 43) by providing a multitude of light sources (e.g., nineteen LEDs at Miller column 6, line 33) that can provide "any desired distribution" (Miller, column 3, line 42) thus providing Rice with precise and accurate control over the illumination, where any frequency content desired can be achieved. Other benefits and advantages of the Miller system are describe throughout the Miller disclosure, including "simplicity and speed" at column 14, line 22.

15. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Horiguchi et al. (US 6,490,365 B2) as applied to claim 16, and further in combination with Kim et al. (US 6,594,377 B1).

Rice does not disclose an ultrasonic distance detector, the system being responsive to determine when the eye is a predetermined distance from the image capture device and providing an indication to the user when the eye is at the predetermined distance.

Kim discloses a system for photographing an eye (figures 2-4), comprising an ultrasonic distance transducer ("the distance detector 18 measures a distance by using the infrared light. However, a detector using an ultrasonic wave may be employed" at column 3, line 59), the system being responsive to the transducer to determine when the eye is a predetermined distance from the image capture device ("the distance detector 18

measures a distance between the user and the optical imager, and transmits the measured distance value to the controller 200 through the optical imager driving unit 24. The control unit 200 judges whether the eye of the user is positioned within a predetermined operational range" at column 4, line 33) and providing an indication to the user when the eye is at the predetermined distance ("When it is judged that the user is positioned within the operational range, the control unit 200 outputs the control signal to the optical imager 100, thereby automatically enabling the optical imager 100. That is, the camera 10 prepares for capturing the iris image of the user, and simultaneously optical imager driving unit 24 outputs to the outside indicator 22 an active signal informing that the optical imager 100 is enabled" at column 4, line 35).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to incorporate the distance detector of Kim, into the system disclosed by Rice, to judge when the user is in the "operational range" (Kim, column 4, line 33), and then to activate the detector for capturing the image and to output an outside "signal informing that the optical imager 100 is enabled" (Kim, column 4, line 41). One would be motivated to do so by the following factors:

To inform the user of immanent image capture and to therefore remain still;

To properly and accurately adjust the focus mechanism based on the exact distance determined as described by Kim at column 4, line 53 through column 5, line 5 (see "The control unit 200 receives the distance value, computes a zoom-in/zoom-out value and a focus value by using a property table of the camera according to a value corresponding to the distance value, and controls a zoom motor and a focus motor of the camera according to the computed value" and "decides a zoom magnification from the

zoom magnification table of the camera according to the previously-set distance by using the distance value between the camera and the iris, transmits the control signal to the camera, and controls the zoom motor of the camera. Accordingly, the zoom lens is directly moved, the focus lens is moved to a corresponding position by controlling the focus motor, and thus the focus is directly controlled"), and

to increase the focusing speed ("the focusing speed is increased" at Kim, column 5, line 5).

16. Claims 40, 41 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Miller et al. (US 6,690,466 B2).

Rice discloses:

an illumination source (figure 1, numeral 12);

a lens through which light passes to illuminate the retina, the lens receiving light reflected from the retina (figure 1, numeral 11); and

an image signal generator responsive to the reflected light to generate a signal representing an image or the illuminated retina (figure 1, numeral 22).

While Rice states, "the frequency content of this light source is selected dependent upon the compound to be analyzed", where "illumination light may be composed of two (or more) separate lighting systems" at column 4, line 43,

Rice does not teach the specific configuration of the light source, including "a red light emitting diode and a green light emitting diode ... combined to illuminate the eye" as required by claim 40.

Miller discloses an illumination system ("illuminator to illuminate a sample" at column 3, line 40), having use in a retinal imaging system as described in the 102 rejection above, comprising a red light emitting diode and a green light emitting diode that combine to illuminate a sample ("provide light having any desired distribution of wavelengths across a broad range" where "all bands may be on, with precisely chosen amounts of light in each band" at column 3, lines 40-45; "Nineteen LEDs having wavelengths from 420-690 nm …" at column 6, line 33; this spectrum covers the entire visual range, including red and green).

It would have been obvious at the time the invention was made to incorporate, as the illumination system required by Rice (e.g., Rice figure 1, numeral 12, the illumination system taught by Miller as described above. One would be motivated to do so in order to facilitate Rice's selection of frequency content using two or more lighting systems (i.e., "the frequency content of this light source is selected dependent upon the compound to be analyzed", where "illumination light may be composed of two (or more) separate lighting systems" at Rice column 4, line 43) by providing a multitude of light sources (e.g., nineteen LEDs at Miller column 6, line 33) that can provide "any desired distribution" (Miller, column 3, line 42) thus providing Rice with precise and accurate control over the illumination, where any frequency content desired can be achieved. Other benefits and advantages of the Miller system are describe throughout the Miller disclosure, including "simplicity and speed" at column 14, line 22.

Regarding claim 41, Rice discloses an alignment system for aligning the eye along a predetermined axis of the system ("a coaxial 'scene' or visual target … in the visual field" at column 4, line 59; "the location of this visual target will bring the optic

disk into the approximate center of the CCD detector" at column 4, line 63; thus, given the target aligns the eye with the center of the CCD, then the eye is aligned in both the x and the y axis of the system as a CCD is a two-dimensional array device), and alignment at a predetermined distance from the device ("focus system 16 … automatically find and bring the optic disk into focus" at column 5, line 22; "a motor drive system that slightly gimbals the lens system" at column 5, line 38 – thus, the lens system is moved to bring the retina into focus; Overall, Rice's fixation target in combination with the motor driven lens system serves to align the eye in the x, y and z coordinates necessary for capturing an in-focus system).

17. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Miller et al. (US 6,690,466 B2) as applied to claim 40, and further in combination with Heacock (US 5,861,938 A).

While Rice requires a lens system that includes a "final lens which can be positioned close to … the cornea" at column 4, line 27,

Rice does not teach specific optical arrangements, including an aspheric surface defined by the equation of claim 42.

Heacock discloses a retinal imaging system (figures 1 and 2), comprising an aspheric objective lens system (figure 2, numeral 50; "The illumination light as it travels towards the patient's eye 14 is slightly diverging. The weaker surface 52 of the aspheric lens makes the slightly diverging illumination light parallel and directs the illumination light to the stronger surface 54 of the aspheric lens 50. The stronger surface 54 of the aspheric lens focuses the illumination light to a point 56 that is centered on the patient's

pupil or generally proximate thereto. The illumination light continues its path until it strikes the retina 58 of the eye 14, thus illuminating an area of the patient's eye within the boundaries of the rays 60 and 62" at column 5, line 35) meeting the exact requirements of claim 42, including the equation recited therein (see Heacock column 6):

> The aspheric lens 50 of the present invention focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22. In order to provide such an aspheric lens, each surface 52 and 54 of the lens is preferably described by the polynomial function:
>
> $$f(Y, A_2, A_4, A_6, C, cc) = A_2Y^2 + A_4Y^4 + A_6Y^6 + CY^2 / \left(1 + \sqrt{1 - C^2 cc}\right)$$
>
> where A_2, A_4 and A_6 are constants; C represents the curvature of the surface; and cc represents the conic constant. For the stronger surface 54 of the lens 50, these values should be within the following ranges:

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize, as the "final lens system" required by Rice, the aspheric lens taught by Heacock as described above. One would be motivated to do so in order to fulfill Rice's requirement for a lens that can be placed close to the cornea ("final lens which can be positioned close to … the cornea" at Rice column 4, line 27). That is, Heacock's lens "focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22" at

Heacock column 6, line 20 and as depicted in figures 1 and 2. Thus, the lens of Heacock can be placed close to the cornea and can serve to illuminate the retina and also focus light reflected from the retinal back to the image plane making it a simple, single lens solution to Rice's optical system which also serves to reduce the overall weight of the portable system disclosed by Rice (e.g., Rice figures 3 and 4). One would also be motivated to utilize the Heacock lens because "the aspheric lens 50 produces a 60 degree field of view ... which is extremely wide" at column 6, line 68, where "the real image produced by the aspheric lens 50 is substantially free from distortions" at column 7, line 4.

18. Claim 55 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Miller et al. (US 6,690,466 B2) and Heacock (US 5,861,938 A).

Regarding claim 55, Rice discloses:

an illumination source (figure 1, numeral 12);

a lens through which light passes to illuminate the retina, the lens receiving light reflected from the retina (figure 1, numeral 11); and

an image signal generator responsive to the reflected light to generate a signal representing an image or the illuminated retina (figure 1, numeral 22).

While Rice states, "the frequency content of this light source is selected dependent upon the compound to be analyzed", where "illumination light may be composed of two (or more) separate lighting systems" at column 4, line 43,

Rice does not teach the specific configuration of the light source, including "a red light emitting diode and a green light emitting diode … combined to illuminate the eye" as required by claim 40.

Miller discloses an illumination system ("illuminator to illuminate a sample" at column 3, line 40), having use in a retinal imaging system as described in the 102 rejection above, comprising a red light emitting diode and a green light emitting diode that combine to illuminate a sample ("provide light having any desired distribution of wavelengths across a broad range" where "all bands may be on, with precisely chosen amounts of light in each band" at column 3, lines 40-45; "Nineteen LEDs having wavelengths from 420-690 nm …" at column 6, line 33; this spectrum covers the entire visual range, including red and green).

It would have been obvious at the time the invention was made to incorporate, as the illumination system required by Rice (e.g., Rice figure 1, numeral 12, the illumination system taught by Miller as described above. One would be motivated to do so in order to facilitate Rice's selection of frequency content using two or more lighting systems (i.e., "the frequency content of this light source is selected dependent upon the compound to be analyzed", where "illumination light may be composed of two (or more) separate lighting systems" at Rice column 4, line 43) by providing a multitude of light sources (e.g., nineteen LEDs at Miller column 6, line 33) that can provide "any desired distribution" (Miller, column 3, line 42) thus providing Rice with precise and accurate control over the illumination, where any frequency content desired can be achieved. Other benefits and advantages of the Miller system are describe throughout the Miller disclosure, including "simplicity and speed" at column 14, line 22.

While Rice requires a lens system that includes a "final lens which can be positioned close to … the cornea" at column 4, line 27,

Rice does not teach specific optical arrangements, including an aspheric surface.

Heacock discloses a retinal imaging system (figures 1 and 2), comprising an aspheric objective lens system (figure 2, numeral 50; "The illumination light as it travels towards the patient's eye 14 is slightly diverging. The weaker surface 52 of the aspheric lens makes the slightly diverging illumination light parallel and directs the illumination light to the stronger surface 54 of the aspheric lens 50. The stronger surface 54 of the aspheric lens focuses the illumination light to a point 56 that is centered on the patient's pupil or generally proximate thereto. The illumination light continues its path until it strikes the retina 58 of the eye 14, thus illuminating an area of the patient's eye within the boundaries of the rays 60 and 62" at column 5, line 35). Heacock's lens meets the following requirements (see Heacock column 6):

The aspheric lens 50 of the present invention focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22. In order to provide such an aspheric lens, each surface 52 and 54 of the lens is preferably described by the polynomial function:

$$f(Y, A_2, A_4, A_6, C, cc) = A_2Y^2 + A_4Y^4 + A_6Y^6 + CY^2/\left(1+\sqrt{1-C^2cc}\right)$$

where A_2, A_4 and A_6 are constants; C represents the curvature of the surface; and cc represents the conic constant. For the stronger surface 54 of the lens 50, these values should be within the following ranges:

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize, as the "final lens system" required by Rice, the aspheric lens taught by Heacock as described above. One would be motivated to do so in order to fulfill Rice's requirement for a lens that can be placed close to the cornea ("final lens which can be positioned close to ... the cornea" at Rice column 4, line 27). That is, Heacock's lens "focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22" at Heacock column 6, line 20 and as depicted in figures 1 and 2. Thus, the lens of Heacock can be placed close to the cornea and can serve to illuminate the retina and also focus light reflected from the retinal back to the image plane making it a simple, single lens solution to Rice's optical system which also serves to reduce the overall weight of the portable system disclosed by Rice (e.g., Rice figures 3 and 4). One would also be motivated to utilize the Heacock lens because "the aspheric lens 50 produces a 60 degree field of view ... which is extremely wide" at column 6, line 68, where "the real image produced by the aspheric lens 50 is substantially free from distortions" at column 7, line 4.

19. Claims 43, 44 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Rice et al. (US 6,305,804 B1) and Heacock (US 5,861,938 A).

Regarding claim 43, Rice discloses:

an illumination source directing light from an LED to illuminate the retina (figure 1, numeral 12; “laser diodes” at column 4, line 45);

a lens through which light passes to illuminate the retina, the lens receiving light reflected from the retina (figure 1, numeral 11); and

an image signal generator responsive to the reflected light to generate a signal representing an image or the illuminated retina (figure 1, numeral 22).

While Rice requires a lens system that includes a “final lens which can be positioned close to … the cornea” at column 4, line 27,

Rice does not teach specific optical arrangements, including an aspheric surface.

Regarding claim 44, Rice does not teach the lens as meeting the aspheric requirements of the equation recited therein.

Heacock discloses a retinal imaging system (figures 1 and 2), comprising an aspheric objective lens system (figure 2, numeral 50; “The illumination light as it travels towards the patient's eye 14 is slightly diverging. The weaker surface 52 of the aspheric lens makes the slightly diverging illumination light parallel and directs the illumination light to the stronger surface 54 of the aspheric lens 50. The stronger surface 54 of the aspheric lens focuses the illumination light to a point 56 that is centered on the patient's pupil or generally proximate thereto. The illumination light continues its path until it strikes the retina 58 of the eye 14, thus illuminating an area of the patient's eye within the boundaries of the rays 60 and 62” at column 5, line 35). Heacock's lens meets the requirements of claim 44 as follows (see Heacock column 6):

> The aspheric lens 50 of the present invention focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22. In order to provide such an aspheric lens, each surface 52 and 54 of the lens is preferably described by the polynomial function:
>
> $$f(Y, A_2, A_4, A_6, C, cc) = A_2Y^2 + A_4Y^4 + A_6Y^6 + CY^2 / \left(1 + \sqrt{1 - C^2cc}\right)$$
>
> where A_2, A_4 and A_6 are constants; C represents the curvature of the surface; and cc represents the conic constant. For the stronger surface 54 of the lens 50, these values should be within the following ranges:

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize, as the "final lens system" required by Rice, the aspheric lens taught by Heacock as described above. One would be motivated to do so in order to fulfill Rice's requirement for a lens that can be placed close to the cornea ("final lens which can be positioned close to … the cornea" at Rice column 4, line 27). That is, Heacock's lens "focuses the illumination light from the illumination system 24 on an area of the patient's eye that is generally proximate to the pupil and the aspheric lens 50 also intercepts light reflected from the patient's eye 14 and focuses the intercepted light onto the image plane 48 that is disposed between the aspheric lens and the eyepiece lens 22" at Heacock column 6, line 20 and as depicted in figures 1 and 2. Thus, the lens of Heacock can be placed close to the cornea and can serve to illuminate the retina and also focus light reflected from the retinal back to the image plane making it a simple, single lens solution to Rice's optical system which also serves to reduce the overall weight of the portable system disclosed by Rice (e.g., Rice figures 3 and 4). One would also be

motivated to utilize the Heacock lens because "the aspheric lens 50 produces a 60 degree field of view … which is extremely wide" at column 6, line 68, where "the real image produced by the aspheric lens 50 is substantially free from distortions" at column 7, line 4.

Regarding claim 45, Rice discloses an alignment system for aligning the eye along a predetermined axis of the system ("a coaxial 'scene' or visual target … in the visual field" at column 4, line 59; "the location of this visual target will bring the optic disk into the approximate center of the CCD detector" at column 4, line 63; thus, given the target aligns the eye with the center of the CCD, then the eye is aligned in both the x and the y axis of the system as a CCD is a two-dimensional array device), and alignment at a predetermined distance from the device ("focus system 16 … automatically find and bring the optic disk into focus" at column 5, line 22; "a motor drive system that slightly gimbals the lens system" at column 5, line 38 – thus, the lens system is moved to bring the retina into focus; Overall, Rice's fixation target in combination with the motor driven lens system serves to align the eye in the x, y and z coordinates necessary for capturing an in-focus system).

Allowable Subject Matter

20. Claims 30-39 are allowed.

21. Claims 4, 18 (assuming claim 18 depends from claim 22; see the claim objections above) and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

22. The following is a statement of reasons for the indication of allowable subject matter: Independent claim 30 and dependent claims 4, 18 and 24, each of which define a retinal image capture system, distinguish over the prior art via. their claimed relationship between an alignment system and a distance detection system. That is, each recite an alignment system comprising an angled channel having a distal light source with first and second states, where the user looking into the channel is in proper alignment when the light is visible, and a distance detector that determines when the eye is within a predetermined distance from the capture system, where the light in the alignment system changes state when the eye is at the predetermined distance. That is, "the single LED 70 provides an indication to the user that the eye 20 is correctly aligned along the longitudinal axis 34 and is at a desired distance from the system 10" at applicant's specification page 13, line 25. This ensures that the user is notified when the proper distance (i.e., z-axis alignment) is achieved in a non-disruptive manner via. the same light source used for the x and y axis alignment. There is no suggestion in any of the above references and without improper hindsight for this combination of elements.

Conclusion

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Werner whose telephone number is 571-272-7401. The examiner can normally be reached on M-F, 8:00 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh M. Mehta can be reached on 571-272-7453. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BRIAN WERNER
PRIMARY EXAMINER

Brian Werner
Primary Examiner
Art Unit 2621
April 13, 2005